

TABLE OF CONTENTS

Preface	xiii
List of Participants	xv
List of Contributors	xxv
1. The Solar Dynamo	
The Solar Dynamo	
D. SCHMITT	1
Turbulent Transport of Magnetic Fields and the Solar Dynamo	
L.L. KICHLATINOV	13
Existence and Energy Balance of the Solar Dynamo	
J.H.G.M. VAN GEFFEN	19
Complete Alpha-Tensor for Solar Dynamo	
V.N. KRIVODUBSKIY and M. SCHULTZ	25
Flux Tubes and Dynamos	
M. SCHÜSSLER	27
Storage of Magnetic Flux in the Overshoot Region	
F. MORENO-INSERTIS, M. SCHÜSSLER and A. FERRIZ-MAS	41
On the Stability of Magnetic Flux Tubes in the Equator of a Star	
A. FERRIZ-MAS and M. SCHÜSSLER	45
Non-Linear Diamagnetic Transport of the Large-Scale Magnetic Field in the Solar Convection Zone	
V.N. KRIVODUBSKIY	49
MHD Turbulence in the Solar Wind and Interplanetary Dynamo Effects	
E. MARSCH and C.-Y. TU	51
Solar Coronal Magnetic Fields	
J. HILDEBRANDT, B. KLIEM and A. KRÜGER	59

2. Long-Term Variability of the Solar Magnetic Cycle

Nonlinear Coupling Between the 110-year Periodic Modulations of Solar Differential Rotation and Solar Cycle	63
H. YOSHIMURA	
Can Mean Helicity Fluctuations Explain the Variability of the Solar Cycle?	71
P. HOYNG	
Magnetic Field and Differential Rotation of the Sun	77
W. KUNDT	
Chaos in Nonlinear Dynamo Models	83
J. KURTHS, A. BRANDENBURG, U. FEUDEL and W. JANSEN	
On the Dimension of the Solar Activity Attractor	91
C.-M. ORZARU	
Dipole Field, Sunspot Cycle and Solar Dynamo	97
P.A. SIMON and J.P. LEGRAND	
On the Fluctuations of the Total Solar Irradiance	107
W. SCHRÖDER and H.J. TREDER	
Solar and Auroral Activities During the 17th Century	109
J.P. LEGRAND, M. LE GOFF, C. MAZAUDIER and W. SCHRÖDER	

3. Numerical Simulations of Convection and Dynamo Processes

Simulating the Solar Dynamo	111
A. BRANDENBURG	
Reynolds Stresses Derived from Simulations	123
P. PULKKINEN, I. TUOMINEN, A. BRANDENBURG and Å. NORDLUND	
A Numerical Approach to Dynamically Consistent Spherical Dynamo Models	129
H. FUCHS, K.-H. RÄDLER and M. SCHÜLER	
Asymptotic Model for Large-Scale Quasiheliotrophic Flow	135
M. GHIZARU	

4. Late-Type and Other Stars

Rossby Number or Rotation Period? K. STEPIEŃ	141
Alpha-Quenched Alpha-Lambda Dynamos and the Excitation of Nonaxisymmetric Magnetic Fields D.M. BARKER and D. MOSS	147
Magnetic Braking of Late-Type Stars L. MESTEL	153
Long-Term Spot Photometry and Differential Rotation of the Spotted Flare Stars EV Lac and BY Dra K.P. PANOV	157
Emission Regions on the Flare Star EV Lac IN 1989 L.A. PUSTIL'NIK, I.P. PANFEROVA, R.E. GERSHBERG and N.I. SHAKHOVSKAYA	161
The HeI $\lambda 10830 \text{ \AA}$ Observations of Two RS CVn Systems ζ and λ And A.G. SHCHERBAKOV, M.J. FERNANDEZ-FIGUEROA, F. MARTIN-PARRA, E. DE CASTRO and M. CORNIDE	167
Dynamo and Fossil Magnetic Field in Young Stars A.E. DUDOROV	171
Enhancement of Magnetic Fields in High-Gravity Stars due to an Intrinsic Dynamo Effect D. ENGELHARDT and I. BUES	177
Bipolar Flows During Early and Late Phases of Star Evolution K. VOLKAMER and C. STREICHER	183
5. Magnetic Field Generation in Accretion Disks	
Dynamo-Action in Accretion Disks W. DEINZER	185
Magnetic Fields in Thin Accretion Disks Around Black Holes R. KHANNA and M. CAMENZIND	193

Generation of Magnetic Fields in Accreting Systems as a Basis of Nonthermal Mode of Energy Release L.A. PUSTIL'NIK and N.R. IKHSANOV	197
Kinematic Dynamo in Turbulent Circumstellar Disks T. STEPINSKI	203
Dynamo Action in Accretion Disks U. TORKELSSON	209
The Internal Wave Driven Dynamo in Accretion Disks E.T. VISHNIAC	211
Accretion Disk Flares in Energetic Radiation Fields R.F. VAN OSS, G.H.J. VAN DEN OORD and M. KUPERUS	217
 6. General Aspects of Dynamo Theory	
Bifurcations and Symmetry-Breaking in Simple Models of Nonlinear Dynamos N.O. WEISS	219
The Magnetic Field Structures of a Class of Fast Dynamos Y.-T. LAU and J.M. FINN	231
Stationary Turbulent Dynamo as Spontaneous Symmetry Breaking M. HNATICH	237
On the Gyrotropic Magnetohydrodynamic Turbulence M. HNATICH and M. STEHLIK	243
The Non-linear Equations for the Green Function and Calculation of the Magnetic Field Turbulent Diffusivities and α -Effect N.A. SILANT'EV	245
Dynamo Driven by Weak Plasma Turbulence Y. TONG and A.C.-L. CHIAN	249
An Improved Reynolds Technique for Approximate Solution of Linear Stochastic Differential Equations J. STAHLBERG	251
Calculation of the Electrical Conductivity of Plasmas with Fluctuations of the Electromagnetic Field C.-V. MEISTER	253

Inverse Energy Cascade in Advanced MHD Turbulence (the RNG Method) N. KLEEOBIN and I. ROGACHEVSKII	255
Non-Axisymmetric Magnetic Structure Generation in Planets Sun and Galaxies S.V. STARCHENKO	263
A Torsion-Induced Coupling Between Electric and Magnetic Fields in the Solar Convection Zone M. SANIGA	269

7. Magnetic Fields in Galaxies: Observations

Radio Astronomy Techniques of Observing Magnetic Fields: The Galaxy R. WIELEBINSKI	271
The Local Magnetic Field in our Galaxy J.-L. HAN and G.-J. QIAO	279
Galactic Dynamos - a Challenge for Observers R. BECK	283
The Intrinsic Magnetic Field Orientation in NGC 4631: Dynamo or Outflow? G. GOLLA and E. HUMMEL	299
High Resolution Observations of the Magnetic Field in IC 342 M. KRAUSE	305
Magnetic Fields in the Spiral Galaxy NGC 6946 M. EHLE and R. BECK	311
The Magnetic Field of M 51 N. NEININGER, C. HORELLOU, R. BECK, E.M. BERKHUIJSEN, M. KRAUSE and U. KLEIN	313
The Magnetic Field of M 83 N. NEININGER, U. KLEIN, R. BECK and R. WIELEBINSKI	315
Magnetic Fields in the Irregular Galaxy LMC R. WIELEBINSKI	317

8. Magnetic Fields in Galaxies: Dynamo Theory

The Galactic Dynamo: Modes and Models G. RÜDIGER, D. ELSTNER and M. SCHULTZ	321
Galactic Dynamos and Dynamics K.J. DONNER, A. BRANDENBURG and M. THOMASSON	333
Towards the Magnetic Field of M 81 D. MOSS, A. BRANDENBURG, K.J. DONNER and M. THOMASSON	339
Numerical Models of 3-D Galactic Dynamos J.S. PANESAR, N. MOORE and A.H. NELSON	345
Nonlinear Dynamo in a Disk Galaxy A. POEZD, A. SHUKUROV and D.D. SOKOLOFF	349
Boundary Layer in Nonlinear Dynamo K.M. KUZANYAN and L. KVASZ	355
Magnetic Field Generation by Galactic Winds S.J. SPENCER and L.E. CRAM	357
Hydromagnetic Dynamo in Astrophysical Jets A.M. SHUKUROV and D.D. SOKOLOFF	367
Nonlinear Interaction between Magnetic Fields and Spiral Arms M. CHIBA	373
Basic Properties of Swing-Excitation Mechanism M. CHIBA and M. HANASZ	375
On the Parametric Resonance in Thin Disk Galactic Dynamo K.M. KUZANYAN and D.D. SOKOLOFF	381

9. Magnetohydrodynamic Phenomena in the Interstellar Medium Related to Dynamo Processes

The Full “Alpha-Tensor” due to Supernovae and Superbubbles in the Galactic Disk K.M. FERRIÈRE	383
The Alpha-Effect by Supernova Explosions M. KAISIG, G. RÜDIGER and H.W. YORKE	389

Galactic Dynamics and Magnetic Field Amplification	
H. LESCH	395
Parker Instability and the Galactic Dynamo	
M. HANASZ and H. LESCH	403
3D-Numerical Simulations of Magnetic Field Evolution in the Turbulent Interstellar Gas	
K. OTMIANOWSKA-MAZUR and M. URBANIK	405
Observational Properties of Helical Magnetic Fields	
M. URBANIK and K. OTMIANOWSKA-MAZUR	411
On the Predictive Power of the Minimum Energy Condition	
M. POHL	413
Dynamical Galactic Halos	
D. BREITSCHWERDT, H.J. VÖLK, V. PTUSKIN and V. ZIRAKASHVILI	415
Generation of the Seed Magnetic Field	
A. LAZARIAN	421
Statistical Method for Astrophysical Turbulence Investigation	
A. LAZARIAN	427
Magnetic Field Generation within Molecular Clouds	
A. LAZARIAN	429
 10. Geodynamo and Planetary Dynamos	
The Geodynamo	
P.H. ROBERTS	431
A New Numerical Scheme in the Solution of the Geodynamo Z-Model	
P. HEJDA and A.P. ANUFRIJEV	441
Time Evolution of the Solution in Model Z	
A.P. ANUFRIEV, I. CUPAL and P. HEJDA	447
Ekman-Hartmann Boundary Layers and the Length of Day Variations	
N. KLEEORIN, I. ROGACHEVSKII and A. RUZMAIKIN	453

Mean Electromotive Force due to Magnetoconvection in Rotating Horizontal Layer in Dependence on Boundary Conditions	
J. BRESTENSKÝ, S. ŠEVČÍK and L. ROSENBERG	457
The Solar Dynamo and Planetary Dynamo	
H. YOSHIMURA	463
Nonlinear Dynamo of Magnetic Fluctuations and Flux Tubes Formation in the Ionosphere of Venus	
N. KLEEORIN, I. ROGACHEVSKII and A. EVIATAR	481

11. History

The Cosmic Dynamo: From $t = -\infty$ to Cowling's Theorem. A Review on History	
F. KRAUSE	487

